Operations at Our Limestone Quarries

By L. W. Hendershott, '22

THE drive up the Scioto past the Storage Dam and on up to the site of the new O'Shaughnessy Dam has been said to be one of the most beautiful in Ohio. Anyone taking this drive cannot help but be impressed by the huge gray gash in the earth, which extends along the western bank of the river for about two miles south from the Storage Dam. In sharp contrast to the otherwise peaceful landscape it is the scene of toil and activity. In the bottom of the pit little trains of cars are hurrying back and forth. Steam shovels that in the distance look to be no larger than match boxes, are emitting clouds of smoke and steam and biting into the stone with a seemingly mad frenzy. Suddenly there comes a series of shrill toots from the whistle on one of the shovels and the activity in the vicinity quickly ceases. The tiny figures, which one takes to be men, disappear. In a moment puffs of white smoke shoot up in front of the shovel, and as bits of rock fly high into the air the reports of the explosions come to the listener's ears. The explosions cease and the spot again becomes the scene of bustle and activity. Passing on, one wonders at the significance of all this and at the purpose of the tall, noisy structures outlined against the sky on the edge of the pit.

Returning homeward later in the evening one finds the entire aspect changed. The place now has the appearance of a brilliantly lighted amusement park. The trains of cars speed along like those on a scenic railway. Looking closely, one can see cars moving up and down an inclined track which reminds one of the Roller Coaster or the Shoot the Chutes. Still the ominous rumbling from the tall structures continues, sounding like the racing cars of "Over the Top" taking a curve side by side, or like dozens of bowling alleys in use at one time. Something vastly more important than the activities of an amusement park must be taking place in the gray pits across the river. This is true. Instead of reveling, the men are quarrying limestone.

The importance of limestone in our present industrial world can hardly be overestimated. On every side we see its uses and applications. In the construction and maintenance of highways and railroad roadbeds, in concrete constructions and in building it finds many uses. A great deal is used in the manufacture of slaked lime and of cement. Powdered limestone is used for treating acid soil. Perhaps its most important use is as a flux in the refining of ores. From the time of the Romans to the present day it has been used in one form or the other in the construction of stadia. A straw vote among college men would undoubtedly reveal that this is the most important use.

ONE OF THE DREDGES AT WORK

The quarries at Marble Cliff are one of the main sources of limestone in this part of the country. As the name of the village near which they are located might indicate, a natural outcropping of the rock occurs at this point. This easy access to the stone, together with the splen-

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did transportation facilities afforded by the nearby railroads and the convenient water supply for the power plants, makes the situation almost ideal.

Quarries have existed at this point for over thirty years, but it is only during the last decade that they have been operated on a large scale. They now embody all of the latest developments in this line. Among the newer features are a water softening plant, which prevents boiler scale, a washing plant for the reclamation of a former waste in the form of dirty gravel, a modern dustmill to pulverize the agricultural stone, and an electric transportation system.

There are several processes through which the stone must pass before the salable article is obtained; it must be uncovered, blasted loose, picked up by steam shovels and loaded into cars, carried to the crushers and broken up into smaller and uniform sizes.

The first operation is the "stripping," the removal of the covering of earth. Compared with the amount at many quarries, there is very little earth on top of the stone at Marble Cliff. The maximum is about fourteen feet. Below the earth there usually occurs about four feet of gravel. These materials are removed by light steam shovels, hauled to abandoned sections of the quarry, and dumped.

The blasting is the most impressive and awe-inspiring part of the process, for here man, through an agency of his own, undoes in a moment what it has taken nature ages to accomplish. In the blasting of the rock two kinds of shots are in common use, which, in the quarryman's parlance, are known as "ledge shots" and "pop shots." The ledge shot is the primary or original one by which a section of the unbroken rock is blasted loose so that it may be picked up by the steam shovels. In these large shots several tons of dynamite are used, and often a section of the ledge two or three hundred feet long and containing thousands of tons of stone, is broken up at one time. The pop shots are much smaller. They break up stones which have been loosened by the ledge shots, but which are too large for the steam shovels to handle.

Before a ledge shot can be made a number of holes have to be drilled in the ledge by means of well drills. The location and depth of these holes vary according to the hardness of the stone and the thickness of the particular stratum of rock which is to be quarried. While these strata vary a great deal at different points, a typical cross section would show a fifteen to twenty-five foot thickness of ballast (railroad or highway stone), under this from seven to ten feet of building stone, and then about forty-two feet of flux. The stone below this is too high in silicon to be of value as flux, and, on account of the trouble with water below a certain level, it is not quarried.

There is always a great hustle and bustle when a ledge is to be blasted; engines puff up to the scene of action pulling little flat cars loaded with dynamite, men carry the boxes of explosives over to the holes, where the wrappers are torn off and the powder dropped down the hole; other men with long tamping rods in their hands press the dynamite into a compact mass at the bottom of the hole and then dump fine stone down on top of the mass so that when the charge is fired the force of the explosion will be exerted in every direction instead of just upward.

When all is in readiness and the wires which carry the electric current to the various charges of explosives are hooked to the switch, the nearby shovels break forth with a series of shrill toots from their whistles. This corresponds to the cry, "fire in the hole" of the smaller quarries. Engines and men move quickly out of the danger zone. A moment later a billow of smoke bursts from the ledge and a dull rumble is heard. The bank of stone slides outward and as the smoke clears away it can be seen that the formerly smooth shelf is now a chaos of jumbled stone with deep fissures extending far into the earth.

This chaos is now attacked by the steam shovels, which, working from the ledge below, bite into the heaps of stone and pile them on the cars. The stones which are too large to load are pushed aside. When several of them have accumulated a hole is made in each with a small drill, operated by compressed air, and sufficient dynamite is inserted to just crack the rock. These "pop shots" are set off by fuses which are lighted by hand. The powder man has to be quite active in order to get all of them lighted and himself out of danger before the firing commences.

In the transportation of the stone from the points where it is quarried to the crushing plant two systems are used. In one system the cars are grouped into trains which are pulled by small locomotives or dinkeys. In the newer system each car is equipped with a motor and is operated as a separate unit on a third-rail track. The movements of these cars are controlled from towers located at commanding positions along the track. This control is accomplished by dividing the third rail into a number of sections, each of which receives its current directly from one of the control towers. If a certain car is to be stopped it is only necessary to cut off the current in the section over which it is passing. Automatic brakes, which go on when the current is shut off, stop the car.

When the cars reach the plant they are pulled up an inclined track from the bottom of the quarry to the crusher and automatically dumped. The crusher, which is of the gyratory or "coffee mill" type, grinds the stone into pieces varying in size from mere flakes to lumps the size of a man's head. These pieces are carried on an endless chain of steel buckets to the top of the plant, where they are dumped into the upper end of a rotating screen. This screen inclines downward at an angle of about fifteen degrees from the horizontal. The holes in it increase in size from the upper to the lower end. The smaller pieces of stone drop through first and slide down chutes to bins beneath. As the stone moves slowly down the screen the larger chunks find openings which will accommodate them and drop into other bins. The pieces which are too large for use pass out the

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lower end of the screen and are carried by a series of moving belts or conveyors to smaller crushers. The stone from these is again passed through screens and properly graded.

Most of the stone is shipped by railroad, although during the summer months a large quantity is hauled in trucks directly from the plants to the places where it is used. The loading of the stone for transportation is simply a matter of spotting the car or truck under the proper bin and opening a gate. The loaded cars are assembled into trains, switched onto the main tracks and the limestone, humbled — in fact, crushed—fares forth to its destination.